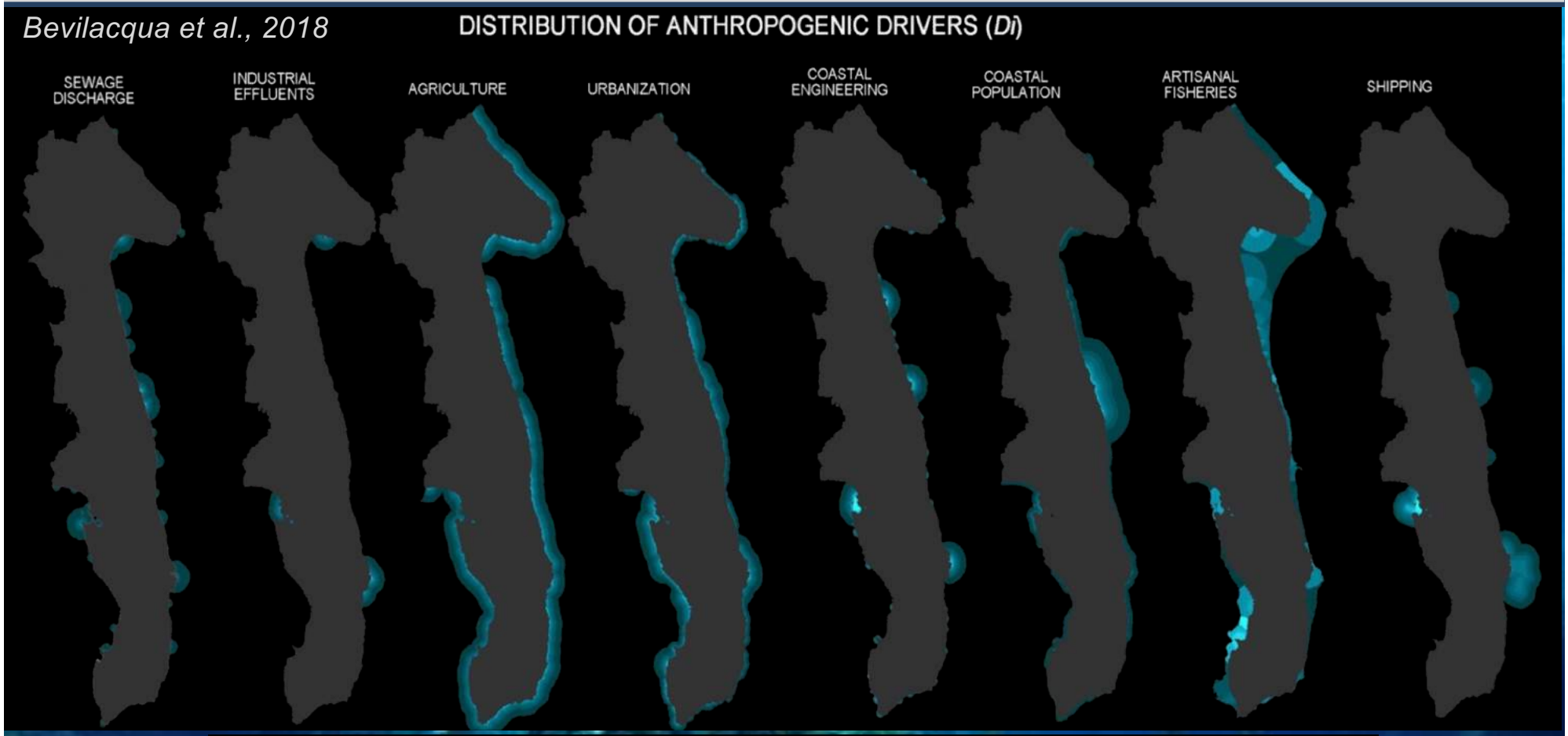
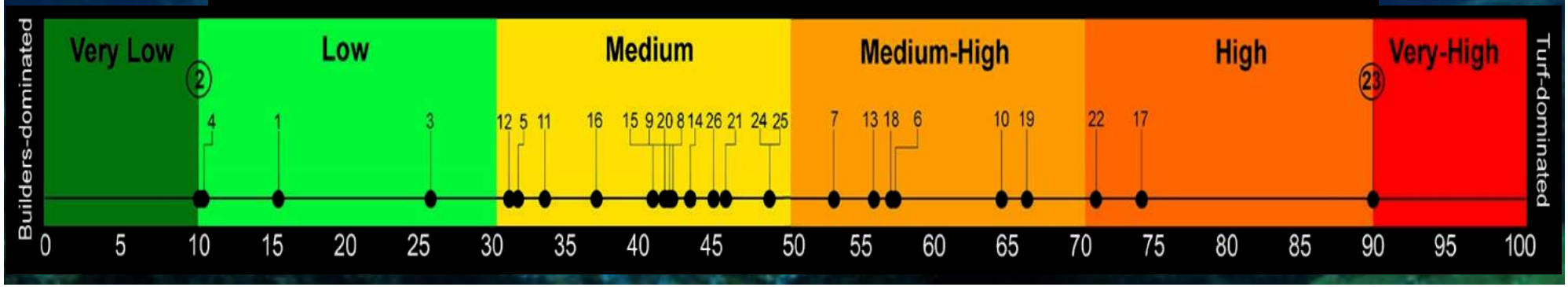
A case study on coralligenous outcrops

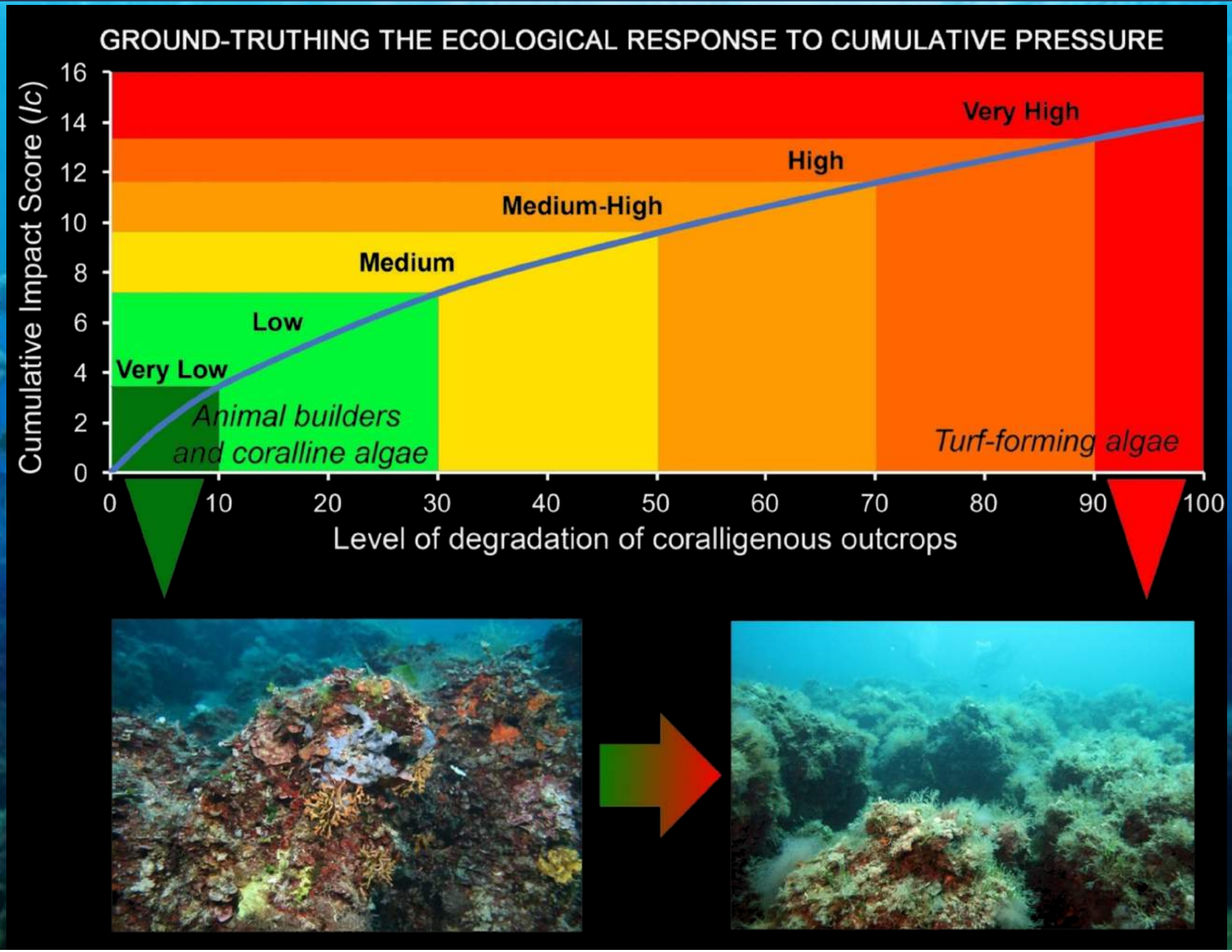
Bevilacqua et al., 2018



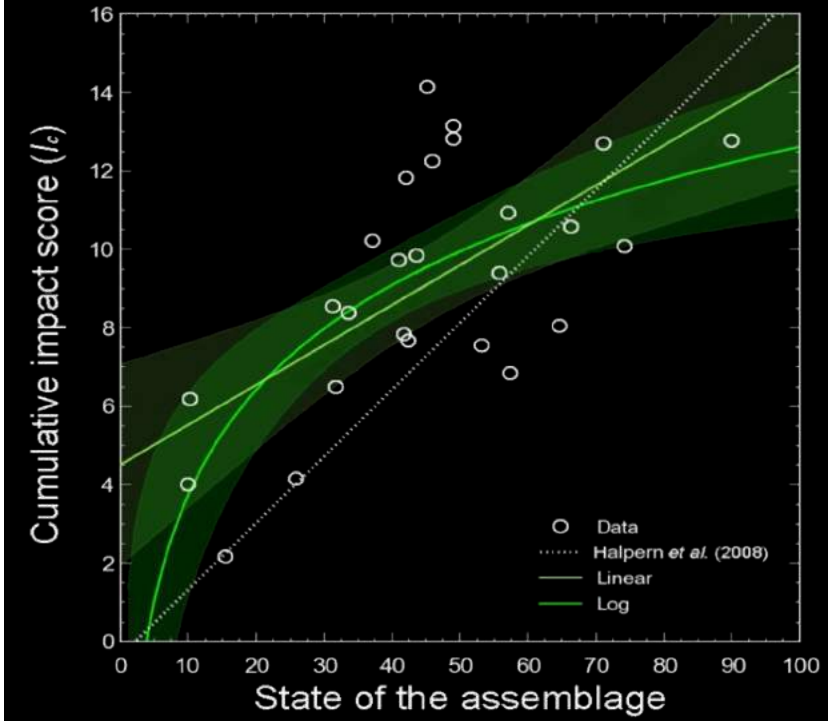
Level of degradation from PCoA axis 1 (>84% explained variation)



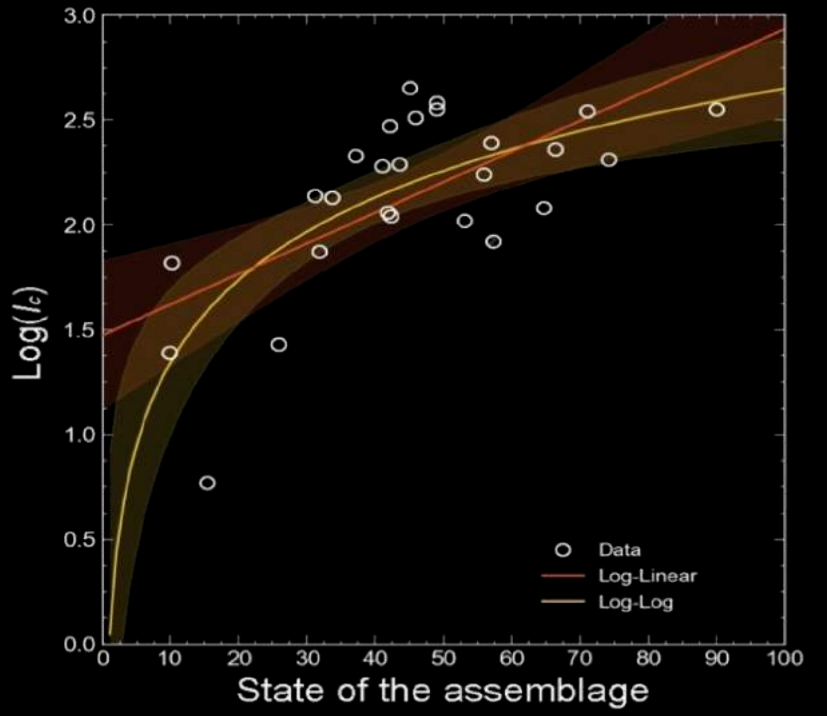
Status of coralligenous

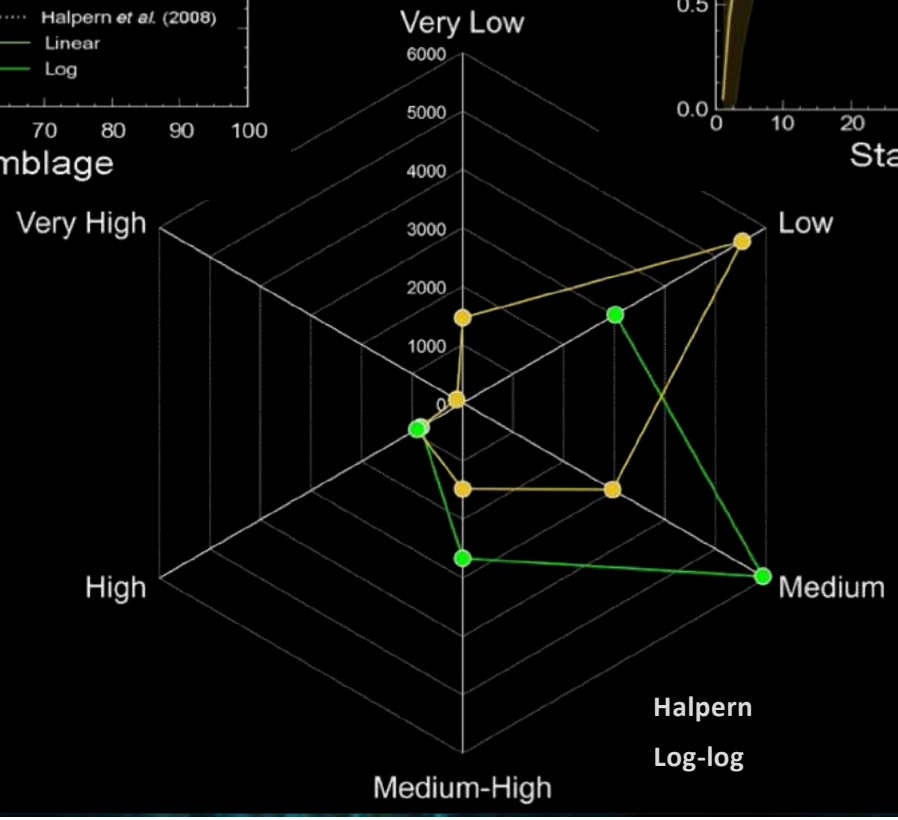


Pressure-response relationship



A log-log model best fitted the pressure-respons relationship Halpern's linear model was unlikely





Thresholds from Halpern's linear model

- very low (<1.4)
- low (1.45-4.95)
- medium (4.95-8.47)
- medium-high (8.47-12)
- high (12-15.52)
- very high (>15.52)

Thresholds from log-log model

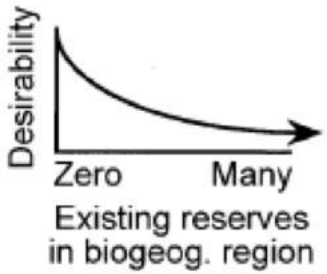
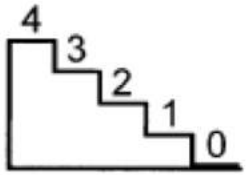
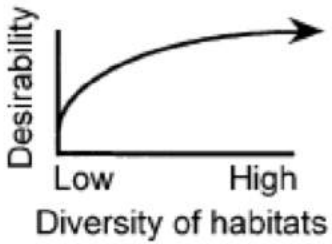
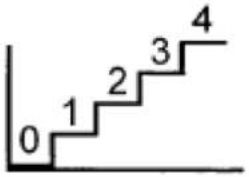
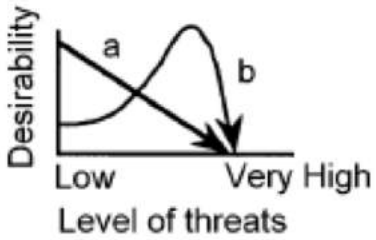
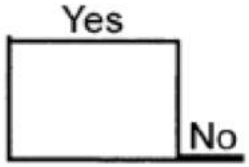
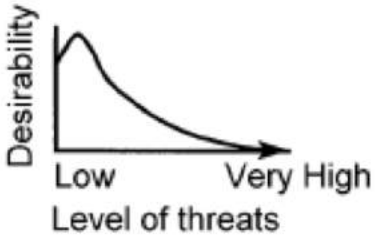
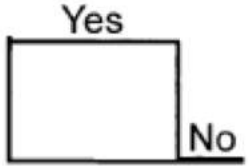
- very low (<3.86)
- low (3.86-7.19)
- medium (7.19-9.59)
- medium-high (9.59-11.6)
- high (11.6-13.37)
- very high (>13.37)

Network of MPAs: general criteria

Roberts et al., 2003

1) Define the goals of the network.
2) Define area of interest.
3) Divide it into possible reserve units. These may be defined in many ways, for example through grids of uniform sized blocks (e.g., 10 km^2), stretches of coastline, habitat classification schemes, or other means.
4) Select criteria for the evaluation of those units that are appropriate to the goals.
5) Decide how to quantify the information needed for determining the level achieved for each criterion.
6) Assemble information on those units (e.g., species or habitats present, levels of threat, etc.).
7) The evaluation process
   a) Characterize or "score" sites based on the following characteristics:
      i) Define biogeographic regions, scoring sites based on what region they occur in. At this stage, sites could be stratified according to region, with site selection decisions made separately for each region. The latter approach would be most useful where a large geographic area is being considered and there are many potential sites from which to choose.
      ii) Define habitats within each biogeographic region for representation.
      iii) Exclude sites subject to excessive levels of threat from human or natural sources.
      iv) Include sites that are already reserves.
      v) Score potential reserves on the basis of habitat heterogeneity and representation criteria, ensuring that reserve units will be sufficiently large to include viable populations.
      vi) Rank or score sites within each habitat type according to other modifying criteria.
   b) Set conservation targets for each of the above criteria (e.g., decide what proportion of the region and of each habitat to protect, what level of replication is required, levels of connectivity desired, etc.).
   c) Select among sites for inclusion in the network (this can be done with an algorithm, by ranking or scoring, or by delphic methods). Criteria may be given different weightings at this stage in order to meet specific network objectives. Map the various possible biologically adequate reserve networks.
   d) Ensure that the networks resulting from the above selection process are sufficiently connected.
8) Use information on alternative, biologically adequate reserve networks to inform final network selection according to socioeconomic criteria.

Network of MPAs: general criteria

Criteria	Relationship	Possible ranking
Prerequisite criteria 1) Biogeography		
2) Habitats a) Diversity b) Diversity *not* protected elsewhere		
Excluding criteria 3) Human threats a) Non-mitigatable b) Mitigatable		
4) Natural threats		

(Boero et al., 2016)

Network of MPAs: general criteria

Modifying criteria

5) Adequacy of size
   a) for conservation
   b) for fisheries

6) Optimal distance apart
   a) for conservation
   b) for fisheries

7) Vulnerable habitats

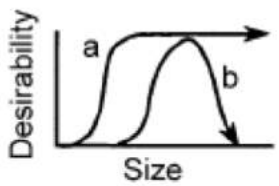
8) Vulnerable life stages

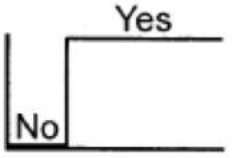
9) Species of special interest (rare, endemic, etc.)

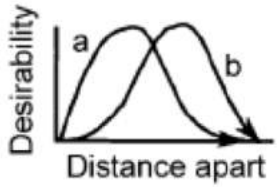
10) Inclusion of exploited species

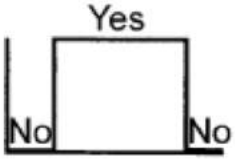
11) Linkages (dependencies) between systems

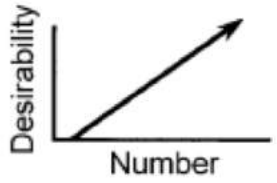
12) Ecosystem services for human needs

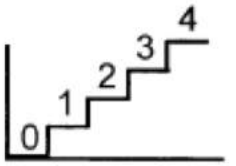








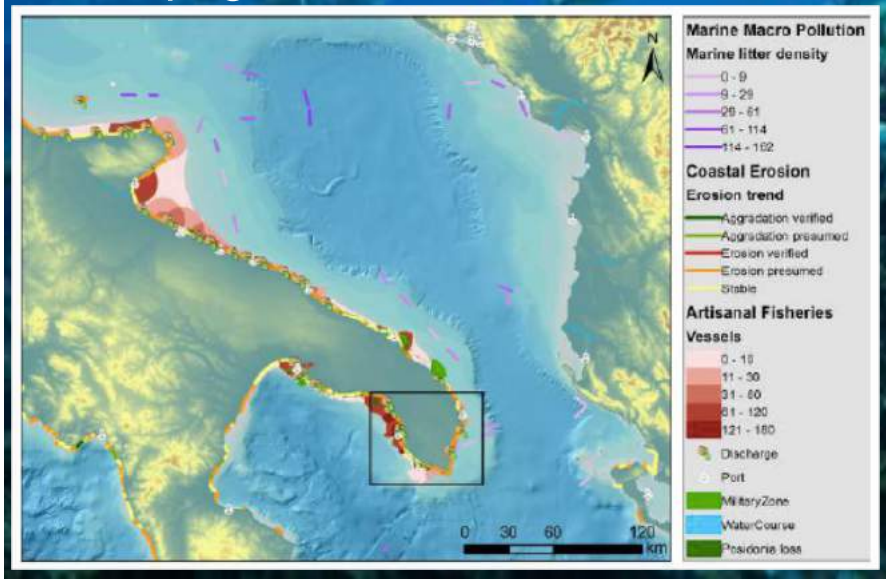


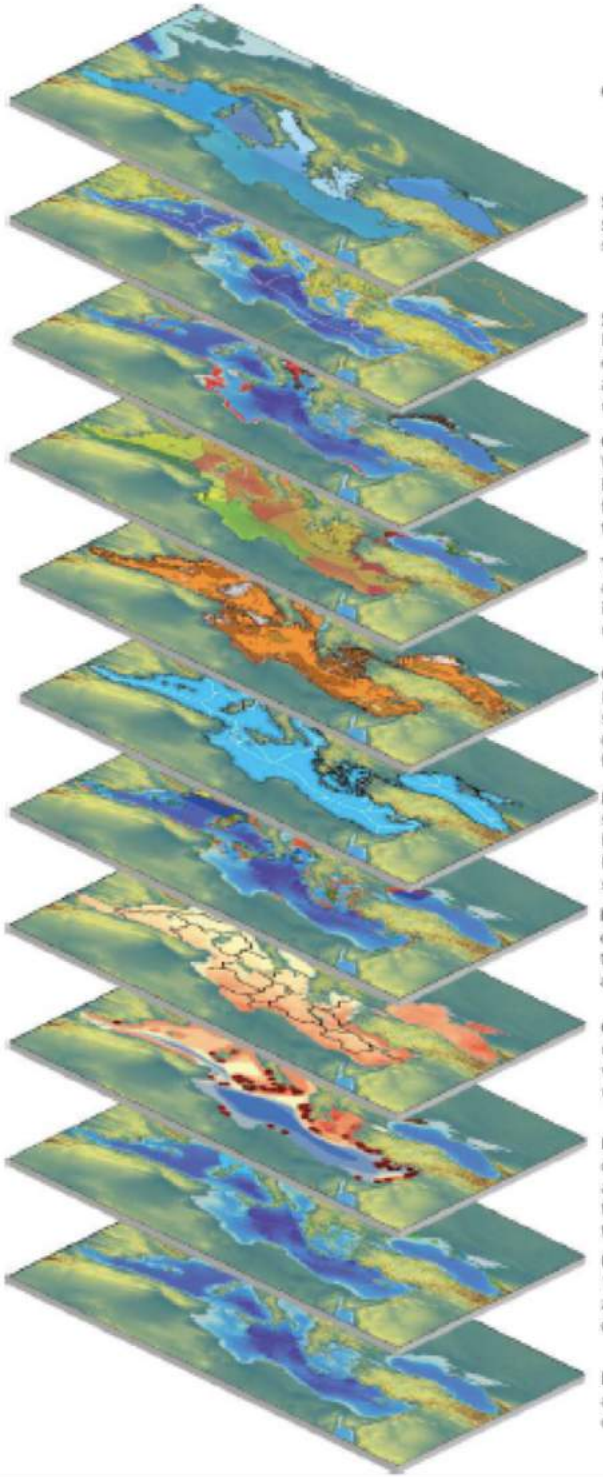


(Boero et al., 2016)

Mapping

Habitat mapping is fundamental for the identification of hot spots of habitat diversity. Maps permit detection of changes in habitat cover, and allow boundary demarcation of multipleuse zoning schemes. Large-scale maps visualise the spatial distribution of habitats, thus aiding the planning of networks of MPAs and allowing to monitor the degree of habitat fragmentation. Geomorphological, oceanographic, biogeographic, biological and anthropogenic features are as well.





GEODATABASE LAYERS

Sea Regions: physical conditions of seas and saline water bodies divided into regions and sub-regions with common characteristics.

Socioeconomics: units of administration at land, dividing areas where States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries.

OWF: existing and planning site for Offshore Wind farms turbines and potential locations based on physical parameters (depth, distance from shore, etc) or environmental data (habitat presence, marine protected sites, etc).

Threats: storing data about natural and anthropogenic activities and impact such as: invasive species, outfalls, marine litter, fishing, navigation routes

Geology: geological samples, geological units (lithostratigraphic units, seabed substrate, system tracks, base of Quaternary, etc), geological structures (folds, faults), geomorphologic features and geophysical elements.

Maritime Units: data about units of administration at sea, dividing areas where States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries.

Habitat and Biotopes: habitats extension and characterization. The geographical information is completed by no-spatial information about species, sources and cover types

Oceanography: data about physical (temperature, salinity, currents), biogeochemical variables (chlorophyll, phytoplankton, dissolved oxygen, etc) and ecoregions.

Biodiversity: species occurrences, species distribution, mammals, birds and turtles at sea and nesting sites at land. Information about taxonomy and sources are stored in related tables.

Protected Site: protected sites at sea and in 15 km inland from the coast.Each site has its zones of protection and its characteristics are described in related table.

Elevation: Digital Elevation models for land and sea surface. Includes bathymetry, marine contours, bathymetric surfaces.

Criteria for selection of MPAs

MPA Selection Factor	Attributes
Knowledge	This covers not only information about the present situation (best available scientific knowledge) but also its historical ecology (how the current situation came about). Unfortunately, it is rare to have such knowledge as there is a general lack of long time series data in the marine environment, but it may be possible to undertake comparative studies to help distinguish features which are artefacts of human influence from those which arise naturally.
Scientific justification	This refers to how well the site accords with accepted ecological criteria (CBD, Habitats Directive), as well as the network contribution e.g. replication and resilience.
Risk assessment	The location of the site should be assessed in relation to shipping lanes, actual or potential industrial development including renewable energy, possible accidental pollution events, attraction of tourists/poachers, colonisation by invasive species, aquaculture or other possible impacts. The potential for mitigating such impacts should be elaborated, for example possible contingency measures to respond to incidents where there is major vessel traffic through the area (Lisovsky *et al.*, 2015).
Political feasibility	Surveys and consultations are needed to confirm stakeholder agreement, from government to civil society at all levels. In particular, any conflict and/or lack of cooperation between environmental and fisheries management agencies will inhibit progress in establishing MPAs.
Legislation applicable and/or available	An audit of the existing local, state and supranational legislation should be undertaken, as well as resource ownership and access, freedom of navigation rights etc. For designation purposes, a check is needed on which littoral states are parties to specific international agreements and how they interpret them in national legislation.
Governance model	The potential governance model (Table 6) should be determined as part of the stakeholder consultation process, and whether and how the site will form part of a network at the international level under the regional agreements.

Criteria for selection of MPAs

Management integrity	The site management plan has to be prepared in full collaboration with the relevant stakeholders. The recruitment of suitable staff, planning competence, effectiveness, monitoring and adaptability are other issues to be taken into account.
Economic sustainability	The need and potential for self-financing of the site administration has to be considered. Sustainable financing needs to be put in place in from the beginning, employing appropriate economic instruments based on assessments, valuations and MCDA.
Communication and outreach	The potential role of the site to provide research, education and public awareness opportunities (forming a part of collaborative networks, Table 1) should be considered.
Secular trends	Natural and political worlds operate as complex systems with characteristics which ensure that they will function unpredictably over time. Therefore, the potential for the site and its management to adopt objectives and policies that are adaptable over short, medium, and long-term timescales is an important factor.

The governance system proposed for a new MPA, or MPA network, is crucial in terms of delivering the benefits expected by the stakeholders during the formation phase. It is important to distinguish between “governance” (which is the strategic, decision making and monitoring process) and “management” (which is the executive role of those responsible for implementing the management plan).

Issues

Effective protection require three main points:

1) as first, MPAs should be sited to fulfill well-defined conservation purposes. This in turn will guide positioning and subsequent conservation strategies. The aims of MPAs should take into account connectivity, population dynamics, diversity distribution and, last but not least, the context to reduce socio-economic conflicts and external human pressures.

2) effective protection cannot fall outside considerations of geopolitical and large scale governance constraints, resources availability to maintain governance of reserves, and therefore enforcement, to avoid creation of 'paper reserves'

3) adaptive management is unavoidable; habitats distribution could change, zonation could require refinements, and monitoring is mandatory to detect changes and implement actions, modifying strategies, or simple to insure that conservation target are being achieved

(Airamè et al., 2003)

Necessary but not sufficient…

Research is demonstrating that marine reserves are powerful management and conservation tools, but they are not a panacea;

They cannot alleviate all problems, such as pollution, climate change, or overfishing, that originate outside reserve boundaries. Marine reserves are thus emerging as a powerful tool, but one that should be complemented by other approaches.

The answer to the question, ‘‘how much is enough’’ is the holy grail of conservation in both marine and terrestrial ecosystems. The goal of marine reserves is to ensure the persistence of the full range of marine biodiversity—from gene pools to populations, to species and whole ecosystems—and the full functioning of the ecosystem in providing goods and services for present and future generations. Because there will always be opportunity costs to conservation, there is a limit to how much we can conserve.

(Lubchenco, 2003)